Iron Manufacturing in 19th Century Western Maryland

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Table of Contents

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Introduction

This book expands on previous works with new material, and discusses a specific topic of the Industrial Revolution in Western Maryland, the iron-making Industry. Starting around 1837, and ending early in the 20th century, the rich natural resources of the western portion of Maryland were used to produce iron, a necessary building block of the Industrial Revolution. By the 1870's Maryland was 5th in the Nation in iron production, and the facility at Mount Savage had rolled the first iron rail in the United States. The facility at Mount Savage, and the earlier one at Lonaconing were cutting-edge, state-of-the-art high technology research, development, and production centers. Essential Patents were issued. Mount Savage was a who's who of industrialization, invention, and technology vital to the nation. In the end, they missed producing the first true steel in the United States, probably by a few months. That was accomplished in Pittsburgh, in a Bessemer Furnace. Mount Savage would up being the supplier of fire brick and refractory ceramics to the Steel City.

There were two major iron manufacturing sites in Western Maryland, both in Allegany County. Lonaconing was the first, and served as a model for the later Mount Savage site. Both were blessed by abundant supplies of raw materials. Both were handicapped by being located in the middle of nowhere. They addressed this issue by building transportation systems involving roads and railroads. Lonaconing was not successful in their timing, but Mount

Savage was. By the time the railroad from Lonaconing was built, the furnace was out of production, and coal became the major commodity being shipped. Mount Savage not only built the first iron rails produced in the United States, they built a railroad with their rails to meet the B&O railhead at Cumberland. They went on to sell rail to the B&O so that road didn't have to keep importing it from England. Mount Savage went on to be a manufacturer of locomotives, producing maybe a hundred of their sturdy iron-workhorses. Lonaconing and Mount Savage both lie along Maryland Route 36, some 14 miles apart. About 11 miles cross-country, when the horse was the transportation method, and forest paths were the route.

The first notable success in this country in making pig iron with coke accomplished at Lonaconing Furnace, in Western Maryland, in 1839, followed in 1840 by equal success at two furnaces of the Mount Savage Iron Company in the same part of Maryland

The Mount Savage rolling mill was built in 1843, especially to roll iron rails, and in 1844 it produced the first rails rolled in this country that were not strap rails. These rails were of the inverted U pattern and weighed forty-two pounds to the yard.

There were several smaller facilities producing iron in the area besides the two sites mentioned. These were of minor importance, but will be discussed later in this document.

This document explores the technology transfer of iron making, first from Wales to Lonaconing in the Georges Creek Valley of Maryland, and from there to the nearby Mount Savage Facility.

Cover photo of the Lonaconing blast furnace by the author.

Timeline

1750 Beginnings of the Tredegar Iron Works set up in Wales.

1805 Tram road for Welsh iron works completed.

1811-12 Big Vein of coal discovered by National Road construction in Eckhart.

1828 C&O Canal and B&O Railroad projects kick off on the same day.

1829 Tredegar Iron Works in Wales gets a Stephenson locomotive.

1837 Blast furnace in operation, Lonaconing.

1838 Md. & NY Iron & Coal (Mt. Savage) chartered in Maryland.

1839 Fire Clay mining in Mt. Savage; C&O Canal reaches Hancock.

1840-41 Mount Savage blast furnishes built; pig iron produced; B&O Railroad reaches Cumberland.

1842 American RR Journal: "No firm in U. S. is capable of producing rail."

1842-47 Canal construction suspended.

1843 Rolling Mill set up at Mt. Savage.

1844 Rail production at Mt. Savage; iron ore discovered in Michigan.

1845 New York Mining Co.; Mount Savage Rail Road reaches Cumberland.

1846 Iron tariffs revoked; Maryland Mining Company Railroad (Eckhart).

1847 Lulworth Iron Co. Mt. Savage; Detmold's tram road to Clarysville.

1848 Mount Savage Iron Co.; largest producer in United States.

1850 C&O Canal reaches Cumberland; Mount Savage furnace in full production.

1852 Georges Creek Rail Road reaches Piedmont, Va.

1855 Last batch of pig iron produced at Lonaconing.

1858 Bessemer Process perfected.

The pieces of the story are: the raw materials, the facilities, the technology, and the customers. We will discuss each of these.

Making pig iron is not terribly difficult. It melts at 2797 degrees F. Actually, it freezes at 2797 degrees F as well. But cast iron, or pig iron is at best an intermediate product. It is not strong in tension, and not suited for many applications beyond casting simple implements. The follow-on process makes wrought iron from pig. Small amounts of wrought iron can be produced by a blacksmith. The industrial process for wrought iron in large batches was developed, but steel was the key for industry. First, we need to discuss the raw materials.

The Raw Materials

Both the Lonaconing and Mount Savage areas have a unique combination of plentiful coal, limestone, iron ore, and fire clay, the ideal basis for a 19th century industrial base. Nothing is more than a few miles away. Given iron ore, limestone, coal, and fire clay for a furnace lining, you can certainly make pig iron.

Fire clay is a specific kind of clay used in the manufacture of ceramics, especially fire brick. The material is named for its refractory characteristics. Fire clay was discovered in the Pottsville formation near Mount Savage in 1837.

Products made from fire clay are resistant to high temperatures, and have a fusion point higher than 1,600°C. They are then suitable for lining furnaces, and as fire brick, and manufacture of utensils used in the metalworking industries, such as crucibles and glassware. Because of its stability during firing in the kiln, it can be used to make complex items of pottery such as piping. Its chemical composition consists of a high percentage of silicon and aluminum oxides, and a low percentage of the oxides of sodium, potassium, and calcium. Unlike conventional brick-making clay, fire clay is mined at depth, usually found underneath a coal seam. The formations in Allegany County range from 5 to 20 feet thick.

Mining of fire clay in Mount Savage began in 1839, and continues to this day. It was also brought from mines on Big Savage Mountain west of Frostburg. The local product was substituted for imported British product. It became a sideline business for the Maryland and New York Iron & Coal Company, but a very necessary one.

The Mount Savage mines were some 2 ½ miles west of the town. The clay bed was from 8-14 feet thick, with a thin layer of coal on top. It contained both hard and soft clay. By 1864, the Mount Savage fire clay became the standard in the United States.

In 1914, The Union Mining Company's four fire clay mines were located 4 miles west of Mount Savage, on Savage Mountain. S. J. Aldon was the Superintendent, with Joseph Jenkins as the Mine Foreman. The mine cars of

clay were hauled to the surface by mules and dumped into larger cars that went down a long plane by gravity. The loaded cars going down the plane hauled the empty cars back up by a cable. At the bottom of the plane, a small (‘dinky”) locomotive hauled the cars two miles to the Mount Savage yards. In the year of 1914, these mines employed 54 men, and produced over 33,000 tons of fire clay.

The Savage Mountain Fire Brick Company had a similar operation, but used horses in place of the locomotive. The clay went by wagon to Frostburg. Production was 10,780 tons in 1914.

The Big Savage Fire Brick Company used mules inside the mine, and a stationary engine to bring the cars a distance of 2 ½ miles to the brick yards at Allegany, on the Cumberland & Pennsylvania Railroad. They produced 11,880 tons per year.

The Mount Savage Refractory is still operating under the auspices of Mr. A. J. Rost of Pittsburgh, who purchased the assets of the Union Mining Company in 1944. This makes the Mount Savage facility the oldest continuously operating firebrick plant in the United States.

There are two major types of fire clay used in the production of bricks. Flint clay, or hard clay, exhibits little or no shrinkage when fired. Plastic, or soft clay absorbs water and is easily workable. The correct mixture is critical. Both types consist of silica and alumina, in different proportions. The deposits available to Mount Savage include both types of clay. Serendipitously, the fire clay is found with seams of coal.

Captain John Smith is generally credited with the discovery of iron ore in Maryland in 1608. There is no evidence that the Native American population ever smelted ore, although they did use it as a pigment. George Washington’s father was involved in the early colonial period iron industry. The iron ore in the vicinity of Mount Savage had a particularly useful yield. It is carboniferous and from the family of Clinton Ores, which are hematite.

Iron ore was mined in various locations in the county, for the furnaces at Mount Savage. One mine that served the Mount Savage facility was on the Samuel Eckles property on the west side of Will's Mountain. This area was worked from 1845 to 1855, and re-opened during the Civil War. Iron ore was

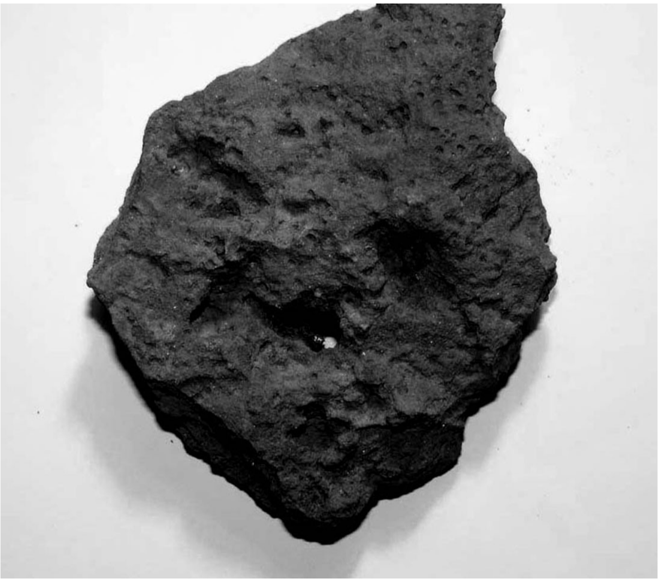
mined in the town of Mount Savage, on the north and west side. The larger mines were on the hill called Ridgeley, about 1 1/2 miles west of town, on the north side of Dutch Hollow. At the foot of the Mount Savage gravity plane, the "Lower Tunnel" was opened in 1846, and was worked until 1853. This tunnel was reported to be 1/2 mile long. The "Upper Tunnel" was located on the property of Henry Collins, and was also about 1/2 mile long. These excavations also yielded fire clay.

Iron ore, author's collection

Iron ore from George Jeffries & Sons nine in Frostburg went to Mount Savage. About 5,000 tons were provided at a cost of $4.50 to $5.00 per ton. The Jeffries paid a royalty of $.25 per ton to the Frosts, owners of the land. The ore bed was 18 inches thick, and was recovered by drift or strip mining. This mine closed about 1855. Jeffries then worked a mine during the Civil War on the Johnson property in Frostburg. This was a parcel of land 2 acres in extent, with a vein 4 feet thick. About 10,000 tons were extracted by 10 men, and numerous teams of horses. Joseph Johnson got a royalty of $.30 per ton.

Bituminous coal is abundant in the Mount Savage region, as part of the Big Vein formation. Coke is better for iron making, being more pure carbon with

fewer impurities. The pioneering use of coke for iron making was the furnace at Lonaconing. Previously, charcoal had been used, leading to a massive destruction of trees to feed the iron furnaces.



Coal was used from the local mines which gave rise to a long period of prosperity in manufacturing bricks, mining coal, and building engines and cars at the railroad shops. Clay was shipped to other manufacturing towns that made cement, lime pottery and enamel ware.

Coke is made by burning coal in a closed atmosphere, which drives off the impurities, and makes the product a more pure carbon. It is a destructive distillation process. Impurities such as sulfur will interfere with the purity of the iron produced, essentially poisoning the batch. What is driven off from the coking process is water and coal gas. The coal gas can be captured and used. At Mount Savage, it was used for the reheating furnaces. It can also provide municipal gas for cooking and lighting, In addition, passing steam or just air over hot coke produces a very clean gas product.

In 1849, coke was produced in Mount Savage on a ledge dug out of the hill, on a level with the top of the iron furnace. The iron furnaces were loaded, or "charged" from the top. These were the first production coke ovens in Maryland. There were 28 of them, said to be smaller than the Connellsville

(PA) ovens. At Mount Savage, the coke was taken out at “white heat,” drenched with water, and left to cool. Coke ovens can reach 2000 degrees Celsius. The process takes a few days.

Coke is less dense than coal, thus easier to transport. Coke cars for railroad use can be larger than coal cars, without exceeding weight limits.

Coke is produced by destructive distillation of low-ash, low-sulfur bituminous coal. In the very simplest case, trenches are filled with coal, set on fire, and then covered with dirt. A more sophisticated process involves baking the coal in a sealed furnace.

Volatile constituents of the coal, including water, coal-gas, and coal-tar, are driven off by baking in an airless furnace or oven at temperatures as high as 2,000 degrees C. This fuses together the fixed carbon and residual ash. Most cokes in modern facilities are produced in "by-product" coking ovens and the resultant cokes are used as the main fuel in iron-making blast furnaces.

Limestone is quarried, not mined. There are many exposed outcroppings of the rock in Western Maryland. It does need to be crushed into smaller pieces. It can then be burned to lime for cement, or for use as a flux for the furnaces. The *Coal Measures* limestone is used for fluxing iron.

Limestone for the Mount Savage furnaces was obtained from the Dunkart Formation, some 2 miles South-East of Frostburg, and from near Corriganville, where the limestone is some 30 feet thick. In fact, the Devil’s Backbone formation with its nearly vertical strata, is all limestone. There are also limestone foundations near Barrellville.

Mount Savage glassy slag, author's collection.

Limestone is used in the iron making process as a flux, a material that traps contaminants. In essence, iron ore is rust. If we remove the bonded oxygen from the iron oxide, we get the pure iron back. That’s the job of the carbon monoxide, produced from the burning coke. This is facilitated by high temperature. Thus, in the furnace, the iron ore is not melted – the oxygen is grabbed from it by the carbon. The free iron then melts and flows. The resulting slag is removed from the furnace, broken up, and used for road building, railroad ballast, and fill – nothing is wasted. The limestone also absorbs impurities from the raw iron, materials such as silicates, sulfur, and phosphorus. The mountains around Mount Savage have large amounts of limestone rock.

Glassy slag from Mount Savage, author's collection

slag, Mount Savage. Note striations.

The Technology

One of the world's major iron producing regions for the Industrial Revolution was Wales. Most of what we know of Welsh iron making in the period is from the papers of the Tredegar Iron Works. (later, an iron works in Richmond, VA, would be named after this facility.) In Welsh, Tredgar means “ten acre town.” it was noted for its abundant natural resources including iron ore and coal, plus water power. It's only problem was its remote location. The facility was built in the age of charcoal, and transitioned to coke as a fuel. Incidentally, the Welsh word for forge is “Ffwrwm.”

The Sirhowy iron works were established in 1750. It used a coal fired blast furnace and a forge. This went on to become the Tredegar facility. Earlier forges were built in the area beginning in 1690, with facilities dating from the 1560's. The owners of the facility were Roger Powell, Roger Williams, and John Morgan. The facility produced pig iron, and bar iron, and was profitable. The facility shipped 150-200 tons of bar iron per year. A major customer was Foley's wire works in Tintern. Surviving records show that 2 ½ loads of charcoal and 2600 pounds of pig were needed to produce a ton of bar, in the forge. Initially, additional pig iron was also imported to feed the forges. Water-powered bellows provided the blast.

The town had an influx of workers, and needed housing. This was provided by entrepreneur Samuel Homfray. The population exploded from 1100 in 1801 to nearly 35,000 by 1881. An interesting perspective on the Town in 1832 is provided in an 1985 book by Adrian Vaught, “Grub, Water, & Relief.”

“Utterly remote at the head of the Sirhowy valley, the town was a man-made hell. Men and children worked killing hours in the smoke and filth of the foundries and were maimed by molten metal. Their only medical help was that administered by the 'Penny Doctor.' Wages were paid in Homfray's private coinage — banks were not allowed in the town — so workers spent their coins in Homfray's shops, buying food at Homfray's prices. Poverty and malnutrition followed and disease followed both.”
Merthyr Tydfil

Merthyr Tydfil was once the largest town in Wales. Merthyr was close to reserves of iron ore, coal and limestone and to water, making it an ideal site for ironworks. Small-scale iron working and coal mining had been carried out at some places in South Wales since the Tudor period, but in the wake of the Industrial revolution the demand for iron led to the rapid expansion of Merthyr's iron operations. Neighboring Dowlais Ironworks was founded by what would become the Dowlais Iron Company in 1759, making it the first major works in the area. The demand for iron was fueled by the Royal Navy, which needed cannon for its ships, and later by the railways. Several railway companies established routes linking Merthyr with ports and other parts of Britain. They included the Brecon and Merthyr Railway, Vale of Neath Railway, Taff Vale Railway and Great Western Railway. They often shared routes to enable access to coal mines and ironworks through rugged country, which presented great engineering challenges. In 1804, the world's first railway steam locomotive, "The Iron Horse", developed by the Cornish engineer Richard Trevithick, pulled 10 tons of iron on the new Merthyr Tramroad from Penydarren to Abercynon.

Welsh Iron workers came to Lonaconing to make the furnace there a thriving business. The furnaces at Mount Savage were modeled on the Lonaconing facility. We should take a look, then, at the state-of-the art in Welsh iron working in the 1830's.

A representative facility that can be visited today is the coke-fired Blaenavon Iron Works in Wales . It operated from 1789 to 1903. It is designated a World Heritage Site.

From their website, "The ironworks, which commenced production in 1789, is the best preserved blast furnace complex of its period and type in the world and is one of the most important monuments to have survived from the early part of the industrial revolution...Today you can view the extensive remains of the blast furnaces, the cast houses and the impressively restored Water Balance Tower. Through exhibitions, advanced interpretation features and reconstructions, you can learn about the international significance of the iron industry and the scientific processes involved in the production of iron. A fascinating insight into the social history of industrial

Britain can be gained by glimpsing into the past at the reconstructed company shop and the refurbished workers’ cottages, at Stack Square and Engine Row. “

http://www.visitblaenavon.co.uk

The Product

Pig iron is the product of smelting iron ore with coke or charcoal using limestone as a flux. Pig iron has a very high carbon content, typically 3.5–4.5% which makes it very brittle and not useful directly as a material except for limited applications.

The blast furnace process of producing iron requires a ready source of iron ore, limestone, a fuel, and a blast. The preferred fuel is coke, nearly pure carbon, made from coal. The preferred blast is heated air. The limestone serves as a flux, to collect the impurities from the ore. Iron ore was mined locally, and limestone came from nearby quarries. Coal was burned into coke on site in long pits. This removed the sulfur and phosphorous, which interfered with the iron extraction process. The process of extracting iron from ore is less of a melting process than a chemical reduction process. The carbon from the coke binds with the oxygen from the iron oxides in the ore, and goes off as carbon dioxide and carbon monoxide. Sometimes, the iron ore was also roasted before being introduced into the furnace. This served to remove contaminants present in the raw ore.

The traditional shape of the molds used for these ingots was a branching structure formed in sand, with many individual ingots at right angles to a central channel or runner. Such a configuration is similar in appearance to a litter of piglets suckling on a sow. When the metal had cooled and hardened, the smaller ingots (the pigs) were simply broken from the much thinner runner (the sow), hence the name pig iron. As pig iron is intended for remelting, the uneven size of the ingots and inclusion of small amounts of sand was insignificant compared to the ease of casting and of handling.

Pig iron is then remelted and a strong current of air is directed over it while it is being stirred or agitated. This causes the dissolved impurities (such as silicon) to be thoroughly oxidized. The metal is then cast into molds or used in other processes. A puddling furnace, fired by coke or by the gas from coke production can produce wrought iron, which can be made into sheets or bars. The bars can be rolled into rails.

Wrought iron is commercially pure iron. In contrast to steel, it has a very low carbon content. It is a fibrous material due to the slag inclusions (a normal constituent). This is also what gives it a "grain" resembling wood, which is

visible when it is etched or bent to the point of failure. Wrought iron is tough, malleable, ductile, and strong in tension. Examples of items that are produced from wrought iron include: rivets, chains, railway couplings, water and steam pipes, raw material for manufacturing of steel, nuts, bolts, horseshoes, handrails, straps for timber roof trusses, boiler tubes, and ornamental ironwork. These are all pieces that can be used to make a locomotive.

Steel differs from iron in the carbon content, which must be carefully controlled. Steel is an alloy of iron with a carbon content between 0.2% and 2.14%. The Bessemer converter in the mid-19th century lead to the mass production of steel. The Mount Savage Works were close to making steel, before Bessemer got his process working in 1858. The first Bessemer steel mill in the United States was established in 1855 in Wyandotte, Michigan, about 14 miles south of Detroit.

A later alternative to the Bessemer process is the open hearth furnace process, using the Siemens regenerative furnace that Mount Savage is known to have had. A temperature of 1600 degrees F must be sustained. A Siemens furnace was first used for steel production in France is 1865.This became the preferred method of making steel.

What if? What if Lonaconing or Mount Savage had produced the first economical steel in the United States? Would Pittsburgh still have developed as the steel-making capitol of the United States?

One of the major impediments to production facilities in the Frontier is that of transportation. For convenience, the production facility is located where the raw materials are. The finished product needs to be transported to the customer base. This makes sense, as the finished product has a higher value (per weight) than the raw materials. To get started, some high tech machinery needs to be shipped to the production site. For example, an iron furnace can be built with local material, but the blowing engines for the blast have to be built in other established facilities, and shipped. It is possible, but difficult, to bootstrap the operation from nothing.

But, Western Maryland did not have much of a transportation infrastructure in the early 1800's. Although both Lonaconing and Mount Savage had an

abundant source of the needed raw materials, both were located, as was Merthyr Tydfil, “in an inconvenient place.” All the facilities needed access to markets for their products.

This got some smart and rich people thinking in Maryland, and the National Road Project, the Chesapeake & Ohio Canal, and the Baltimore and Ohio Railroad were the result. Unfortunately, these came too late for the facility at Lonaconing, but did help the later facility at Mount Savage.

The plans were defined, the capital was procured, the expertise and labor were available. Now they just had to build the facility. The first daunting task was getting the men and materials to the site. No road, no railroad, no canal. After that problem was solved, and the facility was operating, the problem was how to get the finished product to market. The transportation infrastructure was non-existent. People were working on it, but it would happen too late for Lonaconing.

Blue Collar Labor

Many Irish, Welsh and English came here to work in the rolling mills, brickyard, coal mines, and the railroad. The skilled ironworkers came from Wales, and the Irish were mostly common laborers. Competition for labor came from the ongoing railroad and canal construction projects.

The towns were cultural melting pots attracting English businessmen and Irish, Scottish, Welsh, Italian, and German workers.

The company town at Lonaconing, the Residency, was an implementation of industrial feudalism. All aspects of the worker’s lives were controlled. They were brought from Europe by the Company, and were required to pay back the amount of their passage. They were indentured. A skilled worker, in 1880, earned $2.00 for a day’s work of 12 hours in the winter and 10 hours in the summer. He had to work six days a week with only Sundays and Christmas day off. An ordinary laborer earned $1.25 for a single day’s work.

The Mount Savage Iron Works built 280 company houses for their workers in 1847. They were part of the deal, the social contract. The company also built a store and a church, and employed a company doctor.

The brickyard at Mount Savage was lucky to get one John Davis, a former Welsh rolling mill worker. He was of tremendous height and strength. His job was to straighten the crooked rails with a 100 pound mall. He was the only man who could lift and swing it. The mall is still at the brickyard and it is referred to as "The John Davis". Davis is Mount Savage's "John Henry."

We will discuss the technology sites, based on the Welsh model, at Lonaconing, and later, at Mount Savage.

The Lonaconing Residency

In the early 19th century, a 14-foot thick seam of bituminous coal referred to historically as *The Big Vein* was discovered in the Georges Creek Valley. This coal region would become famous for its clean-burning, low sulfur content coal that made it ideal for powering ocean steamers, river boats, locomotives, and steam mills, and machines shops. By 1850, almost 30 coal companies were mining the Big Vein, producing over 60 million tons of coal between 1854 to 1891, with 5,000 men working underground. In the census of 1860, over 90% of the miners could read and write, because the Company built schools and churches for the workforce and their families. After that, large numbers of skilled iron workers were lured from Wales to the wilderness of Western Maryland. By 1838, a sailing ship left Wales, with 73 passengers for Lonaconing. It took 10 weeks to Baltimore. Advertisements in the Baltimore Newspaper sought all kinds of labor. The Town and facility were operated, according to the "Rules of the Lonaconing Residency." This was at least particularly due to the friction among the various ethnic groups, who brought quarrels from the old world. And perhaps also due to American moonshine. The Rules banned fighting, drinking alcohol, and firing guns. Another problem was that the common language was bad English, a second language for most of the workmen.

The Town of Lonaconing is located centrally in the Georges Creek Valley, between Frostburg at the north, and Westernport at the south. Both towns had rail junctions. There were plans to extend the C&O canal through Westernport. Lonaconing became the largest among the dozen or so towns along the Georges Creek, serving as a manufacturing center, a home for companies and miners, and a major retail center. Today Lonaconing is a town of some 1,200, still the largest among the Georges Creek communities. The furnace still stands in a town park, and the office building of the Georges Creek Coal & Iron Company is still adjacent, now used as a residence.

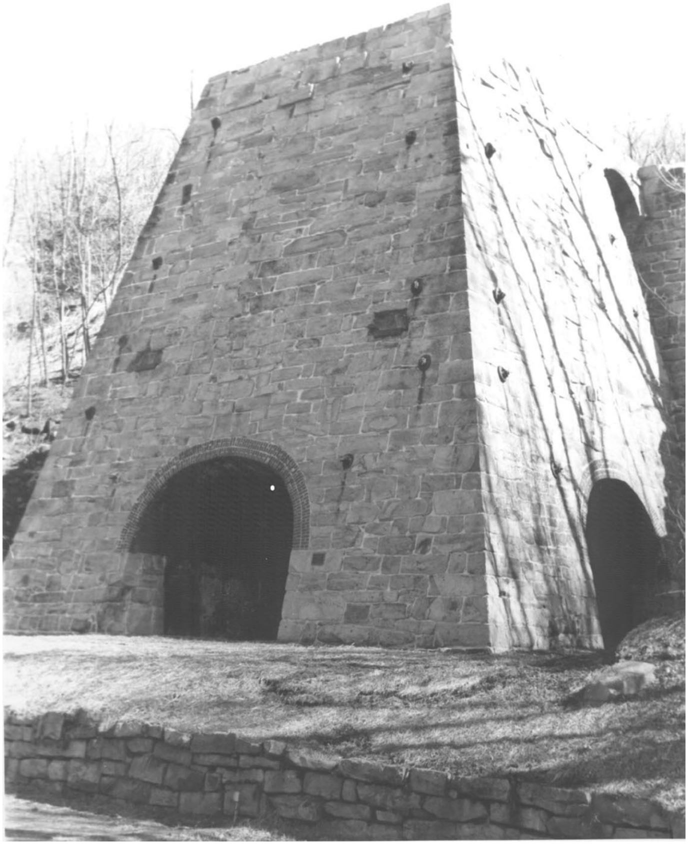
The Companies

This section will discuss the company's that were instrumental in iron manufacturing in Lonaconing.

Georges Creek Coal & Iron Company

The Georges Creek Coal & Iron (GCC&I) Company was formed in 1835, and chartered in the State of Maryland on March 29, 1836. It was backed by British Capital, and managed by investors from New York. The company bought 11,000 acres along Georges Creek from the locals, mostly land grants for Revolutionary War service. The president was John Henry Alexander, who had served as the Maryland State Engineer. He was aware of the vast coal and iron deposits in Western Maryland. His partner was Philip C. Tyson. The 1836 prospectus of the Company outlined a plan to build four coke-fired blast furnaces powered by steam engines. There was also to be a rolling mill, puddling furnaces, steam hammers, and a foundry. The business plan was to produce and sell bar iron, railroad rail, and large castings. The projected workforce was 1,000 men. The plan targeted rail for the B&O Railroad, pushing west from Baltimore. The Lonaconing facility would have transportation access down the Georges Creek to Westernport, Maryland and Piedmont, Virginia, to the railroad and the C&O Canal. The estimated investment cost was $167,930. The technology came from Wales, and Alexander said, "the time will come when ...the Western County of Maryland shall be looked upon as the Wales of North America." Good plan, if they could pull it off. Within months, the investors flocked in, eventually numbering 22. Three thousand shares were offered, at $100. each. The Company was politically well connected in Baltimore and Annapolis. Things were going well.

As the ex-Maryland Geologist, Alexander know a lot about mines, and about iron making. He saw Wales as a model. His vision was to recreate the Merthyr Tydfil facility in the Georges Creek Valley.



Lonaconing Furnace

Merthyr Tydfil, Wales.

English iron making had originally relied on charcoal-fired furnaces, but the British Navy was becoming concerned about the timber supply for shipbuilding. An alternative was coke, produced from coal. The Welsh iron works evolved, and were located where limestone, coal, clay, and water power were prevalent. The furnace was typically built into the side of a hill, so it could be charged (filled) from the top, and the molten iron and slag tapped from the bottom. Water powered bellows provided the blast. The furnaces were constructed from sandstone, in a square pattern, the furnaces

resembling truncated pyramids. Later, large cylinders with pistons replaced the bellows for the draft, and water power switched to steam power. Separate puddling furnaces transformed the crude cast iron into wrought iron. The Puddling process was invented by Henry Cort and patented in 1784. Later, rolling mills for the production of bar iron and rail were introduced. Later, by 1870, the rail business passed to facilities using the Bessemer process for steel.

There is some evidence of women participating in the Welsh operation, in the preparation of the raw materials in the furnace. Hot blast was used by 1844.

Between 1837 and 1839, the new company built an iron furnace in the Welsh pattern at Lonaconing. The furnace, fueled by coke, went into blast in 1839. This was a first for the United States. The abundance of good coal and decent iron ore, like in Wales, made all the difference. Wages were twice the going rate in Wales. Thus, British iron, produced in Wales, was available in America for half the cost of the domestic product.

Not all the pieces fell into place. The railroad down the valley came too late to haul the furnace's product. A canal down the Georges Creek was discussed. An economic depression in the country in 1839-1840 didn't help. The efficiency of scale that would have been achieved by the planned multiple furnaces never happened. The furnace produced 1,860 tons of pig iron in its last active year, 1855. It was then shut down, and abandoned. The C&O Canal never got past Cumberland. The railroad portion of the operation was sold to the C&P in 1863.

In 1910, Georges Creek Coal and Iron became the Georges Creek Coal Company, and operates to this day.

Georges Creek Rail Road

The Georges Creek Rail Road was never chartered as a separate business entity, but was always a part of Georges Creek Coal & Iron. In September of 1851, railroad construction began up the Georges Creek from Westernport, where the B&O had reached Piedmont across the Potomac in Virginia. The railroad was opened on May 9, 1853.

In June 1853, a total of 1,061 tons of coal were shipped on the railroad. In all of 1855, 225,000 tons of coal were shipped, sometimes in 102 car trains. Iron ore or cast iron did not figure into the shipments. In 1856, the line was extended from Lonaconing northward to connect with the Cumberland & Pennsylvania Railroad from Frostburg. The Georges Creek Coal & Iron Company's 9.2 mile railroad was acquired by the C&P on October 23, 1863. The shops and engine house at Lonaconing were used until 1867. The rail line is still in place, but not currently used. As late as 1991, the Georges Creek subdivision of CSX hauled 195,197 tons of coal over this line.

Original motive power in the 1850's were the engine *A. H. Stump*, 2-6-0 from Smith & Perkins, and two Baldwin engines, the 0-8-0 *Georges Creek*, and the 0-6-0 *Lonaconing*. These went to the C&P with the sale of the line, and were all scrapped by 1875.

Surveys were made by Detmold in 1846 to construct a railroad to Clarysville (Claery's Tavern) to connect with the line of the Maryland Mining Company Railroad from Eckhart to Cumberland. This was never accomplished.

The People

Christian Edward Detmold, (2/2/1810-7/2/1887)

Detmold was a major figure in the Lonaconing Iron Furnace. He was a civil engineer by training, born in Hanover, Germany. Detmold had entered the U.S. at age 16, en route to Brazil to join the Army, but decided to stay instead. He did surveys for a railroad in Charleston, S.C., won a $500. prize for a horse treadmill car from the Charleston & Hamburg Railroad & Canal Co., and worked for the U.S. War Department on the construction of Fort Sumter.

From 1845 to 1852, Detmold was directly involved in iron production at Lonaconing. He was responsible for the construction of the tram road in 1847 from Lonaconing to Clarysville. (Sometimes referred to as the Detmold Tramway, or Detmold Railroad). This line connected with the Eckhart Railroad, constructed by the Maryland Mining Company. Detmold leased the furnace, overhauled the boilers, and rebuilt the engine house. The furnace went back into blast in May 1846, and Detmold had a flourishing business by 1847. He was producing 2,500 tons of pig iron annually. The Georges Creek company, perhaps jealous of his success, declined to renew his lease. He moved on to direct construction of the Exhibit of Industry, at the Crystal Palace in New York which opened in July 1853. He held several patents including one dated 1858, when he was living in New Jersey, for a “mode of securing the ends of railway bars.” His 1843 patent, modified and reissued in 1845 (when he was living in New York) was for a reheating process to take cast iron the next step. C. E. Detmold is remembered by having both a town in the Georges Creek Valley, and a C&P engine named after him.

Lonacona

Lonacona, or George Washington Cresap, was the son of Nemacolin, a famous Delaware Chief. In 1751 Thomas Cresap asked his friend Nemacolin to help him in blazing a westward trail because he knew that Nemacolin would know the easiest way over the mountains,

The town of Lonaconing was named for Lonacona. Georges Creek was also named for him. Lonacona died around 1790 in the home of his friend Daniel Cresap, and he is buried in the Cresap Cemetery in Rawlings, MD.

John H. Alexander (1812-1867)

Alexander was born in Annapolis, Maryland. He graduated from St. John's College, and spent the next 4 years studying law. He also attended medical courses in Baltimore, but chose to go to work for the Baltimore & Susquehanna Railroad doing surveys and maps. He was appointed Chief Engineer of Maryland in 1833. He worked on the first complete map of Maryland, and got interested in potential canal routes and coal deposits, for "internal improvement." He resigned from the State, and co-founded the Georges Creek Coal and Iron Company with Mr. Tyson. He laid out the main street of Lonaconing in1837.

He was also Professor of Physics at the University of Maryland, Professor of Civil Engineering at the University of Pennsylvania, and a member of an International Commission on weights and measures. He was a fellow of the American Philosophical Society. He's mentioned in Who's Who in America, Historical Volume. He was the Chair of the Physics Department at St. James College, Maryland, and received a Doctorate there.

His papers (1824-1857) are preserved at the University of Maryland Libraries archives, and at the Maryland Historical Society in Baltimore. He was published in many different fields.

Philip T. Tyson - A Geologist and Chemist, he was a partner in the Georges Creek Coal and Iron Company. He was the State Agricultural Chemist in Maryland, and discovered significant dinosaur fossils in the Arundel Formation in Bladensburg, Maryland, in an iron pit. The Arundel clay is know for its iron ore, and Lower Cretaceous fossils. Mr. Tyson's find was a sauropod, now the Maryland State Dinosaur.

Patrick MaCauly – Baltimore businessman, President of American Life Insurance and Trust, investor in GCC&I.

Richard Wilson - Baltimore businessman, Secretary of American Life Insurance and Trust, investor in GCC&I.

Louis McLean - President of the Baltimore and Ohio Railroad (1836), Secretary of the Treasury under Jackson, investor in GCC&I. He lead the construction of the B&O Railroad westward from Baltimore.

John Steele – Welshman, supervisor for the coal miners, and for coke production.

David Hopkins - Welsh Founder, in charge of building the blast furnace.

John Phillips – One of the "Keepers of the Furnace," supervising filling and tapping.

John Thomas - One of the "Keepers of the Furnace," supervising filling and tapping.

Charles B. Shaw – American engineer and Works superintendent.

David Hopkins – Welsh workforce leader. He got the blast furnace built and operating in 18 months.

Construction of the Facility

The furnace, modeled on the Welsh pattern, was built with locally quarried sandstone. It was to be fifty feet high, fifty feet on a side at the base, and 25 feet wide at the top – a truncated pyramid. It was built against the side of a hill, and charged from the top. The liquid metal would be tapped at the bottom. It could be in continuous blast, as long as the raw materials were available. The interior chamber is 5.5 feet square at the top, and 14.5 feet wide at the widest point, near the bottom. Each face of the furnace had a 16-foot wide brick arch. Cast iron beams were incorporated into the archways. The furnace expanded and compressed during the blast process, as it heated and cooled, and metal stiffening was needed. This took the form of wrought iron bar or rod. At the end, these were looped, and iron wedges pushing against large iron washers locked the bars in place. Some of the bars were threaded for large iron nuts. These can be seen on the structure today. All of the iron pieces for the furnace were shipped in.

A tram road was cut for the stone to reach the building site from the quarries above the furnace. At first, a large sled was used, but was replaced with wheeled ones later. These were of timber construction, built on site.

A large inclined plane was built to supply coal to the furnace. Georges Creek coal is low in sulfur and phosphorus. A pulley system with chains and a large drum at the top allowed loaded cars to pull up empty ones. The iron chain came from England. Ross Winans of Baltimore supplied the iron hardware for the cars, such as wheels and axles. Local farmers rented out their teams and wagons to the company. The masonry contractor was from Pennsylvania, and used local labor to augment his masons. Wooden templates were used to ensure proper placement of the stones for the interior of the furnace. Iron reinforced wooden cranes, and a windlass were used to set the stones. Mortar was produced on site from burned limestone. Lime kilns were built to a French pattern to produce the mortar. Eventually 28 kilns were built.

Bricks, produced on site, were used for the arches, the chimneys, two hot air furnaces, and the furnace for the steam boilers. A Baltimore brick maker lead the team, with several journeymen and lots of manual laborers. The carpenters built the brick molds, and large tables to hold them. There were four kilns. In 1838, the Company consumed a million bricks.

Firebricks were going to be used to line the furnace, but the local fire clay was difficult to work with, and the furnace was eventually lined with sandstone to keep on schedule.

One key ingredient of a blast furnace is the blast. The company bought the necessary machinery from the West Point Foundry in New York City. The machinery went by ship from New York to Georgetown, then by the C&O canal to Williamsport, which was, at that time, the end of the line. Here, the parts were loaded on wagons for the final leg of the journey. The canal charged $3.50 per ton to transport the twenty tons of machinery parts. Only the boilers made it to Lonaconing before the canal froze in the winter of 1837. Ten additional wagon loads from Williamsport arrived at the site in November.

The blast machinery featured a 60-horsepower steam engine fed by five boilers. The steam cylinders were 18 inches in diameter, and 8 feet long. The system operated at a pressure of 50 pounds per square inch (psi). The steam cylinder drove a blast cylinders 5 feet in diameter, and 8 feet long. This forced about 3500 cubic feet per minute of air at 2.5 psi through the system. A very large iron regulator smoothed the air flow from the reciprocating cylinder. The air flowed through a series of pipes in the boiler furnaces and was heated to 600 degrees F. The heated air then entered the blast furnace through two big water cooled nozzles called *tuyeres*. When the water supply failed, the furnace had to be operated with a less efficient cold blast. The first run of good iron came from the furnace on May 17, 1839. By May 23, the furnace was producing six tons per day. Seven tons of coal were required to produce one ton of the cast metal.

The piping for heating the blast came from three Baltimore foundries, including Ross Winans'. Water pipes were made from wood, hollowed logs, and supplied water for the boilers, and to cool the tuyeres. A dam was constructed, with a sand-filled filter. The blast pipes were sealed at the joints with lead, which limited the temperature of the blast to below 620 degrees.

The need for plank lumber for the buildings and houses lead the Company to construct a sawmill capable of producing up to 20,000 board feet per day. It could also produce shingles and lath. The company bought some 20,000 square feet of zinc plate for roofing, from Baltimore.

The company was betting on getting good access to cheap transportation, and bought land in Cumberland near where the canal would be for a wharf facility. Surveys were done for three possible paths for a railroad from Lonaconing to the canal basin at Cumberland. But, in 1839 the Canal was stalled, and still had 50 miles to go.

The Company needed a good access road at least to the National Road. Several routes were surveyed, one through Pompey Smash to Clarysville. The Town of Frostburg wanted the road and its business, so it offered financial incentives to the Company. This is the current Maryland Route 936.

If you drive south on Route 36 today to Lonaconing, the iron furnace is to the right, in a city park. To it's right is the Georges Creek Coal and Iron office building, now apartments. This is all that remains of a large industrial facility. Besides the furnace, there was a foundry with drop hammer, a refinery forge with its own 4 ton hammer, several puddling furnaces, power shears, and puddler rollers. One the basic facility was built, the furnaces and mills could make additional parts for the facility so they did not have to be imported from elsewhere. There was a water-powered sawmill, and a molding house, where the molds for the castings were made. Two big steam engines drove the blast cylinder. Coal and iron ore and limestone were brought from the mines along tramways lined with cast rail made at the facility. Cola was processed into coke in ovens; limestone was ground into powder for fluxing and to make cement, and iron ore was ground into smaller pieces. The facility was in operation 24x7. It was modeled on the Cyfarthfa furnace in Wales.

Operations

Above the furnace were numerous beds of coal and iron ore, as well as the water supply. Veins of iron ore to about a foot in thickness were beside coal in the 14 ¼ foot wide “big vein.” Their were five underground iron mines, and one coal mine. Some open pit mining was also done. Even common labor was becoming hard to find, as the C&O Canal and the B&O Railroad were both under construction. At a yard at the top of the furnace, the ore was roaster to remove impurities, and the coal was coked. The limestone flux was broken into small pieces. All of the charges were weighed, and there were precise portions of the raw materials, as directed by the iron master.

There were 200 men at work at the facility, including 140 miners, 38 furnace hands, and carpenters, blacksmiths, and laborers. Company housing was provided, with work done by the eventual tenants, and by company carpenters. The two-story company store was on Main Street. The store was run by Alexander's brother William. Materials arrived by wagon from Baltimore in 9 days. The company requested a post office be set up in Lonaconing in 1837. Mail to Baltimore took two days. The company built a school and an Episcopal Church. The church was up on the hill, behind the furnace. Services were conducted in Welsh.

Beginning in August of 1837, the Company began keeping a daily business Journal. We are fortunate that these volumes survive.

The furnace was finished, and charged on May 9, 1839. May 17 saw the first iron made in a coke-fired furnace in America appear. The Company reportedly spend $78. on beer.

After 10 days of operation, the tuyeres burned out, and piping was laid to supply water to cool them.

In the late 1830's and early 1840s' the facility was producing 13 tons of quality pig iron per day. There was very little local need for more iron. Shipping by wagon was slow and costly, $120 per ton. The company scaled back and finally ceased production, and began using its stockpile of iron to

produce rails. It went into maintenance mode. The furnace was leased to Christian Detmold in 1846, and continued in operation. He gave it a go until 1852. In 1854, the Company brought the furnace back into operation. Sixty tons per week were being produced. In 1856, the furnace was shut down for good. Costs were high, due to labor and transportation. It wasn't working out.

Industrial site

The Iron Facility

The Georges Creek Coal & Iron Company was formed in 1835. Between 1837 and 1839, the company built an iron furnace at Lonaconing. At the time, there really was no Town on the site, so that was built also. The Welsh-pattern furnace, fueled by coke, went into blast in 1839. It was modeled on the Cyfarthfa ironworks in Merthyr Tydfil, South Wales. These were built in 1765 by a London merchant on 4,000 leased acres. They built a water powered forge, according to the patent by the brother of one of the investors. A chafery was used to reheat iron blooms to produce bar iron. The coke-fired blast furnace was built in 1766. It was 50 feet height, with steam-powered blowing cylinders, not the usual bellows. It went into blast around 1767. Pig iron from nearby Plymouth iron works was initially used for the forge, before the blast furnace was completed. The facility went on to cast cannon for the British Board of Ordnance. By the mid 1840's the local iron supplies were exhausted, and iron ore had to be imported by the facility.

In Lonaconing, there was plenty of iron ore, water, wood, and coal locally, but the major problem the company faced was transporting finished products to market. Production reached 75 tons per week, and local iron needs were quickly satisfied. Some products were shipped out by wagon, including such items as dowels for the C&O Canal lock walls. The adjacent casting house made farming implements, mine car wheels and track, and household utensils. The furnace output was in the form of pig iron, which was sold to be recast, or worked.

Ore for the furnace came from mines on the hill behind the furnace. Tram roads were used to transport the ore to the furnace. Later, the mine tunnels were used as storage cellars by residents on the hill. Ore was also mined on the opposite hillside, above the (later) silk factory, and the area around Buck Hill. Ore also came from Koontz. The *Tilley Field* was on Hugh Weir's property, on the east side of a fork of Laurel Run. Another tunnel was located on the Philip Hansel land, just south of Tilley Field. It was reported to be 6 feet high, and a 100 feet long. From 1848 through 1858, ore came from the area around Pompey Smash (Vale Summit), on the south side of Dan's Rock Road.

This facility was located in the wilderness. There was no connection to the Potomac River or the National Road, and no railroads yet in existence. It was a challenge to get men and equipment in, and iron products out. The Cumberland Road, part of the later National Road, was 8 miles to the north. The Potomac River was a similar distance to the south. Georges Creek ran roughly north to south, from a source near Frostburg, to the Potomac at Westernport. Large mountains lay to the east and west.

With production going well, iron piled up in Lonaconing. In 1842, sales of pig iron to foundries in Cumberland were begun, with delivery by wagon. An adjacent sawmill and lumberyard, also owned by the company, recorded sales to the Mount Savage Iron Works, then involved in building their own furnaces. In the fall of 1842, pig iron was offered to the B&O railroad at a price of $29. per ton, but delivery was still a problem. After experimenting with a horse powered tram road, the company realized that a rail line, built down the Georges Creek Valley toward the Potomac River at Westernport, would be the answer to the transportation issue. The rail line was finished from Lonaconing to Piedmont in 1853, where it connected with the recently arrived B&O Railroad. It was, unfortunately, too late to provide the needed market access for the Lonaconing facility. The furnace in Lonaconing was abandoned in 1855, and the canal was never extended past Cumberland.

The furnace complex at Lonaconing was visited by the Superintendent of Construction for the B&O, Mr. Casper Wever, Esq., in June of 1839. Shortly afterwards, the shareholders of the C&O Canal visited. With the furnace up and operating, the facility expansion plans included a forge and rolling mill. However, these were never built. The company began to concentrate on the railroad to meet with the canal and the railroad at Westernport. By 1850, surveys were complete.

The furnace sat idle for many years. It was named to the National Register of Historic Places, and was rehabilitated and stabilized by the firm of Meyers and D'Aleo, Inc. of Baltimore. It still sits in the City Park in Westernport.

The Georges Creek Railroad

This railroad was to be the solution to the transportation of the iron product out of Lonaconing. It came too late to save the company, however. The line was owned and built by Georges Creek Coal & Iron.

The B&O Railroad reached Piedmont, across the Potomac River from Westernport, in July of 1851. In September of that year, railroad construction began up the Georges Creek. The railroad was opened on May 9, 1853. In June, a total of 1,061 tons of coal were shipped. In all of 1855, 225,000 tons of coal were shipped, sometimes in 102 car trains. Iron ore or cast iron did not figure into the shipments. In 1856, the line was extended from Lonaconing northward to connect with the C&P from Frostburg. The Georges Creek Coal & Iron Company's 9.2 mile railroad was acquired by the C&P on October 23, 1863. The shops and engine house at Lonaconing were used until 1867. These were located just north of where the road to Dan's Mountain State Park merges with State Route 36, at Water Station Road, north of Lonaconing. Interestingly, this section of line still saw use in 1998 for on-demand coal service. In 1991, the Georges Creek subdivision of CSX hauled 195,197 tons of coal over this line, as compared with the 225,000 tons by the Georges Creek Rail Road in 1855. The line is still in place, but currently out of service. Some of it at the southern end was acquired by the Georges Creek Railway, a start-up Class-3 shortline, operating out of the mill at Luke.

Mount Savage, Iron Empire

Mount Savage is a community in Allegany County with a current population is 2200. Drive through the Town of Mount Savage today, and you would probably only remember it for the dog-leg turn and the narrow main street.

It was in 1844 that Mount Savage was put on the nation's map with the rolling of the first iron rail in the United States. After this claim to fame, Mount Savage became the fifth largest city in Maryland. Today, no more iron is made at Mount Savage, nor do locomotives roll out of the shops. Little coal is mined, but the fire brick and refractory materials industry continue.

Alternate (unofficial) names for Mount Savage have been Arnold Settlement, Corriganville, Jennings, Jennings Run, Jennons (sic) Run, Jennings Post Office, and Lulworth.

Many buildings in Mount Savage are on the Register of Historic Places. The Mount Savage Historic District comprises 189 buildings, structures, and sites within the 19th and 20th century industrial community northwest of Cumberland. The resources within the district reflect the community's development as a center of the iron, coal, brick, and railroad industries from the 1830s to the early 20th century. A broad variety of domestic, commercial, religious, and industrial buildings and structures represent all phases of the town's development during this period. The town's commercial center is located on Main Street, and consists primarily of two and three-story commercial buildings dating from the turn of the 20th century. Most are of frame construction, but some are built with glazed brick, an architectural novelty produced in local brick works. A rich collection of domestic architecture is concentrated to the north, east, and southwest of the commercial area. Most of the houses are 1 1/2 or 2-story frame buildings, simplified interpretations of popular turn-of-the-20th-century styles, such as the Bungalow-influenced houses which line New Row and Foundry Row. Late-19th century fashions are represented by notable frame Gothic houses, an Eastlake-influenced brick example, and a group of large frame Queen Anne houses. Several vertical-board duplexes overlook the former site of the Maryland and New York Iron and Coal Company operations, established in 1839. This site is currently occupied by the Mount Savage Refractories brick

works, the present descendant of the fire-brick industry which has operated continuously in town since the mid 19th century.

The Mount Savage Historic District is significant for its association with the industrial development of the Western Maryland region, and for its rich architectural resources representing a wide variety of types and styles of domestic, commercial, religious, and industrial buildings and structures reflecting all phases of the community's development from the mid 19th to the early 20th centuries. The vertical-board duplexes on Old Row are especially noteworthy as possibly the earliest examples of workers' housing remaining in the region.

The Companies

This section discusses the various 19th Century companies establishing the iron business in Mount Savage.

Maryland & New York Iron & Coal Company (1838-1847)

On March 12, 1838, The Maryland and New York Iron & Coal Company was incorporated by Louis Howell, Benjamin B. Howell, and Henry Howell. The Howell Brothers of New York were bankers and brokers who could arrange for money for projects with a large anticipated rate of return. Benjamin Howell visited the Mount Savage area sometime before 1839, and liked what he saw. He ventured to England to gather Capital for an Iron Works; he succeeded to the extent of $600,000. The company was authorized to build a railroad from its mines at Mount Savage to the C&O Canal and the B&O Railroad at Cumberland by the terms of the charter: Both the B&O Railroad and the C&O Canal were on their way to Cumberland at this time.

Howell probably read Alexander's reports on the Lonaconing Project, picked out the ideas that worked, and discarded those that didn't. He build the Mount Savage facility in an area with the right raw materials (iron, limestone, and fireclay), but also with an existing community of potential workers, and infrastructure. Also, a rail connection to Cumberland was considered from Day 1. Howell purchased 3,700 prime acres from Andrew Bruce for $33,000. 1839 saw the construction of the first furnace. Until the railroad was completed to Cumberland, the right-of-way was used as a road, for horse-drawn wagons.

Louis Howell had vast land holdings and mines in Allegany County. The State charter allowed the Company to build or acquire railroads, as long as they did not interfere with the B&O, or the C&O Canal. They were also required to erect an Iron Works, and produce 1000 tons of pig, cast, or bar iron in one year. It is important to remember that when the legislature granted the rights to build a railroad, they included the right to condemn and acquire private land if it were needed to build the line.

Other investors included Joseph Weld, Thomas Weld Blundell, John Folliott Powell, and Robert Samuel Palmer of the U.K., and several other American investors.

Louis Howell was lost at sea on the side wheel steamship *President* in 1841. The ship was at the time the largest steamship ever built. She was on her third crossing of the Atlantic. One could speculate that Mr. Howell was heading to England to raise Capital for his venture.

The State charter says:

“And be it enacted, That for the purpose of enabling said company to transport the produce of the mines and of the counties through which their rail road shall pass, on the cheapest and most expeditious manner, the said company and the president and directors thereof shall be, and hereby are respectively invested with all and singular the rights, profits, powers, privileges, authorities, immunities and advantages fur the surveying, locating, establishing and constructing a rail road and its necessary appurtenances, beginning the same at the mines of the said company and running to a convenient point or points on the basin or canal of the Chesapeake and Ohio Canal Company, at or near the town of Cumberland, in this State, and for the using, preserving and controlling the said rail road, its necessary vehicles and appurtenances and every part thereof, or borrowing money on the credit of the company for its lawful purposes; provided, that no such borrowing of money shall imply a right to borrow or purchase the stocks of the State, or any other description of property whatever, which by the act, and more particularly the fifteenth section thereof, incorporating the Baltimore and Ohio Rail Road Company, and its several supplements, were for the lawful purposes of said company, and the benefit of its corporators given, granted, authorized and secured to the said company and to the president and directors respectively, as fully and perfectly as if the same were herein repeated; provided, that" it shall not be lawful for the said Maryland and New York Iron and Coal Company to occupy or use any portion of the lands that may be necessary for the accommodation of the canal and works of the Chesapeake and Ohio Canal Company, or for the main route of the Baltimore and Ohio Rail Road, or that may be within the limits of either of the public roads there now existing, except to cross these roads without injury to the same; and provided also, that full right and privilege is hereby reserved to the citizens of this State, or any company now or hereafter to be incorporated under the authority of this State, to connect with the rail road hereby provided for, or any other rail road, if in the opinion and judgment of the commissioners of Allegany county, for the time being, passed upon hearing of all parties interested, no injury would be

done by such connection to the rail road of said company, and that the said company shall transport on the said rail road at the rate of one cent a ton per mile on all goods, merchandise or property of any description whatsoever transported on said rail road, or on any lateral way which they may construct, and also not exceeding two cents per mile for each passenger transported on said road; provided always, that when any car shall be placed on said rail road it be adopted in size, and all necessary particulars to said rail road; and provided further, that the Legislature of this State may at any time hereafter regulate, modify or change the control, use, and estate of said rail road as shall be constructed under the authority hereby given, in such manner as it may deem equitable towards the said company, and necessary to the accommodation of the public travel or use of the said rail road."

Later, in 1841, the Charter was amended:

"Be it enacted by the General Assembly of Maryland, That it shall be lawful for the Maryland and New York Iron and Coal Company, to charge, demand and receive, for all persons and property transported on the rail road and any lateral way, which they are authorized to construct from their mines to the basin of the Chesapeake and Ohio Canal, or other points, in or near the town of Cumberland, the same rates of toll, or prices of transportation as the Baltimore and Ohio Rail Road are, or shall be, by law allowed to charge and receive. And whereas, doubts may exist whether the said company would be authorized, under the act to which this is a supplement, to construct a rail road from their mines or Works, to some intermediate point or points between the basin of the Chesapeake and Ohio Canal at Cumberland and their works or mines aforesaid, should circumstances render the extension of their road to the basin of the canal at Cumberland unnecessary, as will probably be the case, if the Baltimore and Ohio rail road company, or the said canal company, extend their works up the valley of Jennings' run, to give additional facilities to the coal and iron trade—therefore,"

"Be it further enacted, That it shall not be necessary for the said Maryland and New York Iron and Coal Company, to construct their said rail road or any lateral way from their said works or mines to the basin of the said canal at Cumberland, but that the same may be stopped at any intermediate point, at the discretion of the company, and that it shall be lawful to charge the same rates of toll for the transportation of persons and property upon such road when constructed, as are authorized by the first section hereof; provided, that

the said rail road be constructed so as to intersect with the extension of the Baltimore and Ohio rail road, or the Chesapeake and Ohio canal, or the improved navigation of Wills' creek, by canal or otherwise."

"And be it further enacted, That a quorum for the transaction of business of the said Maryland and New York Iron and Coal Company, shall hereafter consist of the President and any two Directors, as required by the fourth section of the act to which this is a supplement "

The Mount Savage rolling mill was built in 1843 by the Company, but it was not the path to financial success that they hoped. The company had to borrow $30,000 from Mr. Semmes, but that was only a short-term proposition. In 1848, the company failed, partially because Congress had decided to lift protective tariffs on British rail. Its property was sold at auction to John M. Forbes of Boston, who conveyed it to the Lulworth Iron Company, which had been incorporated in 1846.

Lulworth Iron Company (1847-1848)

The Lulworth Iron Company was chartered in the state of Maryland on March 1, 1847. The key players were Samuel M. Semmes, John G. Lynn, Henry Thomas Weld, Jonathan Guest, and Robert Samuel Palmer. They were empowered for "…carrying on the manufacturing of iron, and of articles of which iron is a component part, and for opening, working, transporting to market and vending the products of their lands, mines, manufactories…"

The charter continues, "That for the purpose of enabling said corporation to transport the produce of its mines and manufactories to market and elsewhere, in the cheapest and most expeditious manner, the said corporation and the president and directors thereof, shall be, and are respectively invested with all and singular the rights, profits, powers, privileges, authorities, immunities and advantages for the surveying, locating, establishing and constructing a rail road or rail roads, with the necessary appurtenances, beginning the same at or near the mines or manufactories of the said corporation, and running to a convenient point or points at or near the town of Cumberland, or to such other point or points as may best suit the convenience and interest of said corporation, and for the using, preserving and controlling the said rail road or rail roads, and the necessary vehicles and appurtenances thereto belonging, and every part thereof, which by the act, and more particularly the fifteenth

section thereof, incorporating the Baltimore and Ohio Rail Road Company and its several supplements, were for the lawful purposes of said company, and the benefit of its corporators given, granted, authorized and secured to the said company, and to the president and directors respectively, as fully and perfectly as if the same were herein repeated; provided, that it shall not be lawful for the said Lulworth Iron Company to occupy or use any portion of the lands that may be necessary for the accommodation of the canal and works of the Chesapeake and Ohio Canal Company, or for the main route of the Baltimore and Ohio Rail Road, or that may be within the limits of either of the public roads there now existing, except to cross these roads without injury to the same; and provided also, that full right and privilege is hereby reserved to the citizens of this State, or any company now or hereafter to be incorporated under the authority of this State, to connect with the rail road or rail roads hereby provided for, or any other rail road, if in the opinion and judgment of the commissioners of Allegany county, for the time being, passed upon hearing of all parties interested, no injury would be done by such connection, to the rail road of said corporation; and that the said corporation shall transport on its said rail road or rail roads, all persons and properly, at the same rates of toll and prices of transportation as the Baltimore and Ohio Rail Road Company are, or shall be, by law, allowed to charge and receive; provided however, that in all cases where a connection is formed between the rail road or rail roads hereby authorized to be constructed, and the rail road or rail roads of any other corporation or citizen of this State, the cars to be used in the transportation of persons and property shall be adapted in size and all necessary particulars to the rail road or rail roads of the said Lulworth Iron Company; and provided further, that the Legislature of this State may at any time hereafter regulate, modify or change the control, use and estate of the rail road or rail roads to be constructed under the authority hereby given, in such manner as it may deem equitable towards the said corporation, and necessary to the accommodation of the public travel or use of the said rail road or rail roads."

In the early deeds and records the community around the furnaces was called Lulworth because the Lulworth Iron Company once owned the clay and manufacturing rights. But later the name Mount Savage appeared when it was sold again, taking its name from the one the people living in the area preferred. As a matter of record, however, the community that was slowly growing up around the brick yard, blast furnaces and railroads, was called "Savage Mountain Hamlet", but as the town grew larger, the Hamlet was

dropped and "Savage Mount" continued in use for many years. Whether the "Mount Savage" had a more lyrical sound than "Savage Mount" is not known, but it became reversed and ever since was called Mount Savage. Lulworth Iron later changed its name to Mount Savage Iron Company on Feb. 7, 1848.

Mount Savage Iron Company (1848-1867)

A major investor in Mount Savage Iron was Erasmus Corning, of New York. He made John F. Winslow the President of the Company. The Mount Savage Rail Road had been built with "Winslow's Patent Rail." This was a British patent.

John A. Graham (the first president of the Cumberland & Pennsylvania Railroad) with fellow directors John F. Winslow, Warren Delano, John M. Forbes, and Joseph B. Varnum ran the company.

Lulworth Iron was essentially split into two parts. The railroad went to the C & P, and the iron manufacturing went to Mount Savage Iron. The two companies shared directors.

Mount Savage Iron did not pay cash for the shares; rather, it conveyed its existing railroad operations, stretching from the B&O depot in Cumberland and the Potomac Wharf to the mines near Frostburg, to the newly formed C & P Railroad. Thus, Mount Savage Iron was out of the railroad business directly, and the C & P was in. Mount Savage Iron completed the Canal Wharf (ex-Lynn Wharf) in Cumberland in 1850. Canal boats were loaded in the Potomac, then entered the canal via the guard locks. Mount Savage Iron operated the Mount Savage Rail Road until 1854, when it went under C & P control.

New York Mining Company (1845)

The New York Mining Company was chartered in the State of Maryland in February 26, 1845. The incorporators were Oroondates Mauran, Barrett Ames, Robert B. Minturn, Jonathan Sturges, Charles Dennison, and Samuel M. Semmes. It was allowed to mine coal and iron, and manufacture and sell iron products. Mr. Mauran was a wealthy New York businessman, who with his partner Cornelius Vanderbilt, owned the Staten Island Ferry. Robert Bowne Minturn was one of the most prominent American merchants and

shippers of the mid-19th century. Today, he is probably best known as being one of the owners of the famous Clipper Ship, the Flying Cloud. He was a New York merchant, involved in the China and transatlantic trade. He and his wife donated the land for New York's Central Park.

Mount Savage Fire Brick Company (1841-present)

The Mount Savage Brick Works established its first plant in 1841. The bricks were shipped all over the country. The Mount Savage Firebrick Co., now located now in Zihlman, is still in operation.

Captains of Industry

This section discusses some of the movers and shakers, the enablers and the technology experts who came together to make Mount Savage Industry happen.

Samuel Middleton Semmes

Semmes was born in Charles County, Maryland, in 1811. His brother Raphael went on to become an Admiral in the Confederate States Navy. Samuel graduated from Georgetown Law, and was admitted to the bar in Allegany County. He drafted most of the charters of the pioneering coal companies in Allegany County. He served as State Senator from 1855 to 1866. He was associated with Lulworth Iron, and the New York Mining Company. Semmes died in 1867.

John Galloway Lynn

The Lynn's were an 18th century Maryland family. J. G. Lynn's Father had moved to Cumberland, building a substantial brick house and estate on the West Side known as Rose Hill. John Galloway became a Cumberland businessman, and built the Lynn Wharf along the Potomac River. This was sold by his heirs to the Maryland Mining Company. In 1849, Lynn and the Mount Savage Rail Road incorporated the Cumberland and Pittsburg (sic) Rail Road Company. Their eyes were on the grade over the Alleghenies to Pittsburgh, but nothing seems to have come of the venture.

Henry Thomas Weld

Weld was an English immigrant. The Weld's Lulworth Estate is located in central south Dorset, England. Its most notable landscape feature include a five mile stretch of coastline on the Jurassic Coast. Part of the area is now a special World Heritage Site. The estate is predominantly owned by the Weld family who have lived there for several generations. The Lulworth estate was once part of a grand estate under Thomas Howard, 3rd Viscount Howard of Bindon. The historic estate, hosted the stately Lulworth Castle, which was the residence to the Weld family until 1929 when it was ravaged by fire.

Henry was associated with Welds Boatyard in Cumberland, later the Weld & Sheridan Boat Building & Repair Yard at the C&O Canal basin.

Warren Delano

Warren Delano II was the maternal grandfather of President Franklin Delano Roosevelt. During a period of twelve years in China, Delano made more than a million dollars in the tea trade in Macau, Canton and Hong Kong, but upon returning to the United States, he lost it all in the Panic of 1857. In 1860, he returned to China and made a fortune in the controversial but highly profitable opium trade, supplying opium-based medication to the U. S. War Department during the Civil War. The Delano Mining Company operated in Mount Savage, producing coal. His partner was James Roosevelt around 1870.

The future President spend some summers with his grandfather, who lived in the Bruce estate. Delano was a director of Consolidation Coal 1864-1875, and a Director of the C & P Railroad. He had a C & P locomotive named after him, a Winans Camel, in 1859.

John M. Forbes (1813-1898)

Along with Jay Gould and E. H. Harriman, John Murray Forbes of Boston was an important figure in the building of America's railroad system. From March 28, 1846 through 1855, he was president of the Michigan Central Railroad, and a Director and President of the Chicago, Burlington and Quincy Railroad. He spawned a vast 19th century Industrial Empire, starting early in the century in the China Opium trade. He and his partner Erasmus Corning of Albany bought the Mount Savage Iron works for $200,000, which was about one fifth of its value. The facility had gotten into cash flow problems, and this was the kind of deal Corning looked for. He and Forbes added the rolling mill that produced the first successful iron rail in America. The "Forbes Group" went on to acquire railroads all across America.

In *Letters and Social Aims*, Ralph Waldo Emerson said of Forbes: "Never was such force, good meaning, good sense, good action, combined with such domestic lovely behavior, such modesty and persistent preference for others. Wherever he moved he was the benefactor. How little this man suspects, with his sympathy for men and his respect for lettered and scientific people, that he is not likely, in any company, to meet a man superior to himself," and "I think

this is a good country that can bear such a creature as he." (Forbes' son married Emerson's daughter).

John F. Winslow

Winslow was a partner of Erasmus Corning, and worked at the Albany and the Rensselaer Iron Works in New York in 1837. He was an engineer, iron master, the inventor of compound rail, and President of the Mount Savage Iron Company in 1848. He traveled extensively in Europe in 1852, buying the rights to iron and steel processes. In 1861, he partnered with John Ericson on his Navy contract to build an iron clad war ship, the *Monitor*. Some of the techniques he developed for making hardened iron plate may have come from his work at Mount Savage in the period 1848-1852.

Besides a British patent for rail, Winslow held several American patents, including number 35407, 1862, for "Improved Armor Plate for Vessels," number 34177, 1862, for "Compressing Puddle Balls," and number 4526 of 1846 for "Malleable Iron from Ores." This latter was when he worked for Corning in Troy, NY. He was also a Director of the Cumberland & Pennsylvania Railroad.

William Borden

He was president of the Borden Mining Co., circa 1875. The Borden Family was from New York. They had founded the water-powered industrial town of Fall River, Massachusetts, outside of Boston.

Enoch Pratt (1808-1896)

Pratt was a Capitalist, and a friend of Andrew Carnegie. He was born in Massachusetts, where he learned iron making. He arrived in Baltimore in 1831 with $150, and went on to make his fortune. E. Pratt & Brothers (Hardware), 23-25 S. Charles St., Baltimore. He was a director of the Maryland Steamboat Co., Director of the Susquehanna Canal Co., Vice-President of the Philadelphia, Wilmington, & Baltimore Railroad, and director of three other Railroads. He built and donated a public library system to the City of Baltimore.

Iron manufacturing in Mount Savage

Many Irish, Welsh and English came to Mount Savage to work in the rolling mills, brickyard, coal mines, and the railroad. The skilled iron workers came from Wales, and the Irish were mostly common laborers. Competition for labor came from the railroad and canal construction projects. The town was a cultural melting pot attracting English businessmen and Irish, Scottish, Welsh, Italian, and German workers. The Mount Savage Iron Works built 280 company houses for their workers in 1847.

The C & P Railroad shops employed 250 to 600 men, and another several hundred were busy at the fire brick works. The railroad operating crews were the best paid in the region. In 1880, Engineers got $3.50 per day, conductors $2.50, firemen $2.10, and brakemen $1.95. Boilermakers in the shops got $2.10 a day.

A skilled worker, in 1880, earned $2.00 for a day’s work of 12 hours in the winter and 10 hours in the summer. He had to work six days a week with only Sundays and Christmas day off. An ordinary laborer earned $1.25 for a single day’s work.

The brickyard was lucky to get one John Davis, a Welsh former rolling mill worker. He was of tremendous height and strength. His job was to straighten the crooked rails with a 100 pound mall. He was the only man who could lift and swing it. The mall is still at the brickyard and it is referred to as "The John Davis". Davis is Mount Savage's "John Henry."

Getting the Raw Materials

The raw materials required for the production of iron includes iron ore, limestone, refractory clay, and coal, transformed to coke.

Coal mining
Coal was used from the local mines which gave rise to a long period of prosperity in manufacturing bricks, mining coal, and building engines and cars at the railroad shops. Clay was shipped to other manufacturing towns that made cement, lime pottery and enamel ware. When the brick building beside the railroad tracks was built in 1881 the lumber came from the dismantled Philadelphia Exposition.

Coke Production

Coke is made by burning coal in a closed atmosphere, which drives off the impurities, and makes the product more pure carbon. It is a destructive distillation process. Impurities such as sulfur will interfere with the purity of the iron produced, essentially poisoning the batch. What is driven off from the process is water and coal gas. The coal gas can be captured and used. At Mount Savage, it was used for the reheating furnaces. It can also provide municipal gas for cooking and lighting, In addition, passing steam or just air over hot coke produces a very clean gas product.

In 1849, coke was produced on a ledge dug out of the hill, on a level with the top of the iron furnace. The iron furnaces were loaded, or “charged” from the top. These were the first production coke ovens in Maryland. There were 28 of them, smaller than the Connellsville (PA) ovens. At Mount Savage, the coke was taken out at “white heat” drenched with water, and left to cool. Coke ovens can reach 2000 degrees Celsius. The process takes a few days.

Coke is less dense than coal, thus easier to transport. Alternately, coke cars for railroad use can be larger than coal cars, without exceeding weight limits.

Limestone mining

Limestone is not really mined, but quarried. There are many exposed outcroppings of the rock in Western Maryland. It does need to be crushed into smaller pieces. It can then be burned to lime for cement, or for use as a flux for the furnaces. The Coal Measures limestone is used for fluxing iron.

Limestone for Mount Savage furnaces was obtained from the Dunkart Formation, some 2 miles South-East of Frostburg, and from near Corriganville, where the limestone is some 30 feet thick. In fact, the Devil's Backbone formation at the north-west side of the Narrows, with its nearly vertical strata, is limestone. There are also limestone foundations near Barrellville.

Clay Mining

Mining of Fire clay in Mount Savage began in 1839, and continues to this day. It was also brought from mines on Big Savage Mountain west of Frostburg.

Originally mined in 1839, the local product was substituted for the British product. It became a sideline for the Maryland and New York Iron & Coal Company, but a very necessary one.

The Mount Savage mines were some 2 ½ miles west of the town. The clay bed was from 8-14 feet thick, with a thin layer of coal on top. It contained both hard and soft clay. By 1864, the Mount Savage fire clay became the standard for such in the United States.

Serendipitously, fire clay usually found with seams of coal.

The iron ore around Mount Savage is carboniferous and from the Clinton Ores, which are hematite.

Mount Savage Blast Furnaces

The furnace at Lonaconing was a model for the ones at Mount Savage, and there was technology sharing, if not downright industrial espionage between the two facilities. Three furnaces were built at Mount Savage, but only two went into service. The two that did go into blast resembled the furnace at Lonaconing, fifty feet high, fifteen wide at the bosh, and built against the side of a hill. They were on the south side of Jennings run. The third furnace was not built against a hill, and would have had to be loaded by derrick. The furnaces were lined with firebrick, produced locally. That fire clay and firebricks became the basis of a business that continues into recent times. The Lonaconing facility produced its last batch of pig iron in 1855.

Iron Furnace, Mount Savage.

The blowing engines at Mount Savage came from the West Point Foundry in New York in 1845, as had the ones for the furnace at Lonaconing. They were sized for furnaces making 400 tons of iron per week. Then engines were of the condensing type (recycling water), with a 56-inch diameter cylinder and a 10 foot stroke. They made 15 revolutions per minute, producing steam at 60 pounds per square inch and generating 80 horsepower. The associated boilers were 60 inches in diameter and 24 feet long. The grates spanned a total of 198 square feet. The blast cylinders were massive, being 126 inches in diameter with a 10 foot stroke. They operated at 15 revolutions per minute, and supplied air at 4-5 pounds per square inch pressure. One engine was used for the blast furnaces, and the other for the rolling mill. At the time, they were the largest cast cylinders in the world.

Early experiments with a coke-fueled furnace at Mount Savage in 1842 had produced acceptable iron at a cost of $16. per ton, when English iron was available for $15.84. A tariff bill, passed by Congress in 1846, removed protective duties on imported iron products. This benefited the English and Welsh manufacturers, at the expense of the fledgling American shops. This action was a direct cause of the failure of the Maryland & New York Iron & Coal Company, owner of the facility at Mount Savage. A poor showing for

the facility that was, at one time, the largest manufacturer of iron in the United States. Mount Savage, at the time, represented one of the largest and most successful technology research and development facilities in the country, if not the hemisphere.

The 1846 Walker tariff was a United States Democratic Party-passed bill that reversed the high rates of tariffs imposed by the Whig-backed "Black Tariff" of 1842 under president John Tyler. The Democratic Party is one of the two major political parties in the United States. A tariff (sometimes known as a customs duty) is a tax on imported or exported goods. The Tariff of 1842, or Black Tariff as it became known, was a protectionist tariff schedule adopted in the United States to reverse the effects of the Compromise Tariff of 1833.

The Walker tariff act was named after Robert J. Walker, who was formerly a Democratic Senator from Mississippi and served as Secretary of the Treasury under president James K. Polk. The tariff's reductions coincided with Britain's repeal of the Corn Laws earlier that year, leading to a decline in protection in both. The Corn Laws, in force between 1815 and 1846, were import tariffs ostensibly designed to protect British farmers and landowners, against competition from cheap foreign grain imports.

Its adoption was seen to increase commerce between the United States and Britain. It was also predicted that a reduction in overall tariff rates would stimulate overall trade, and with it imports. The result, asserted Walker, would be a net increase in tax revenue despite a reduction in the rates. The Kane Letter was a widely circulated letter written by James K. Polk to James Kane outlining his beliefs on tariffs, free trade, and protectionism during his 1844 campaign for President of the United States.

The Democratic-controlled Congress quickly acted on Walker's recommendations. The Walker Tariff bill produced the nation's first standardized tariff by categorizing goods into distinct schedules at identified ad-valorem rates rather than assigning individual taxes to imports on a case by case basis. The bill reduced rates across the board on most major import items save luxury goods such as tobacco and alcohol. An ad-valorem tax is a tax based on the assessed value of real estate or personal property.

Shortly after his election President Polk asserted that the reduction of the "Black Tariff" of 1842 would constitute the first of the "four great measures" that would define his administration. This proposal was intended to be the fulfillment of his campaign pledge in the Kane Letter on tariff policy that contributed to his victory in 1844 over Henry Clay. In 1846 Polk delivered his tariff proposal, designed by Walker, to Congress. The Tariff of 1842 placed a duty on pig iron of $9. per ton, and for manufactured iron, $25. per ton. The ad-valorum tax was set at 30%. Higher tariffs were good for the iron industry, but bad for the railroads.

The bill resulted in a moderate reduction in many tariff rates and was considered a success in that it stimulated trade and brought needed revenue into the U.S. Treasury, as well as improved relations with Britain that had soured over the Oregon boundary dispute. As Walker predicted, the new tariff stimulated revenue intake from $30 million annually under the Black Tariff in 1845 to almost $45 million annually by 1850. Exports to and imports from Britain rose rapidly in 1847 as both countries lowered their tariff barriers against each other.

The 1846 tariff rates initiated a fourteen year period of relative free trade by nineteenth century standards lasting until 1860. It was passed along with a series of financial reforms proposed by Walker.

The Walker Tariff remained in effect until the protectionism, which reduced rates further. Both were reversed in 1861 with the adoption of the Republican-backed Morrill Tariff.

Producers from other traditional protectionist constituencies such as iron, glass, and sheep farmers opposed the bill. When the Panic of 1857 struck later that year, protectionists, led by economist Henry C. Carey, blamed the downturn recession on the new Tariff schedule. Though economists today reject this explanation, Carey's arguments rejuvenated the protectionist movement and prompted renewed calls for a tariff increase. The Tariff of 1857's cuts lasted only three years. In 1861, the country changed course again under the heavily protectionist Morrill Tariff. But it was too late for Maryland & New York Iron & Coal.

In the 1850’s, the blast furnaces of Mount Savage had blazed around the clock, consuming massive amounts of coked coal, iron ore, scrap iron, and limestone. According to surviving records, in June of 1856, 356.5 tons of iron were produced. This required 747 tons of iron ore (at a 39 percent yield), 1.77 tons of coke per ton of iron produced, and 1.19 tons of limestone per ton. For this process, 536 tons of coal went to the blast engines. All of this raw material was dug by hand. The cost of production totaled $23.39 per ton, including anticipated repairs to the furnace, and wages. In 1844, number 2 furnace was in blast for 40 weeks, and produced 4,500 tons of iron. In 1846, number 1 furnace was in blast for 44 weeks, and produced over 4,500 tons. The integrated manufacturing center at Mount Savage, with its associated transportation infrastructure, represented the very cutting edge of the Industrial Revolution in America, and rivaled the best in the world. Economic issues, not technological ones, forced the shutting down of the blast furnaces in the late 1840's, but it re-opened during the Civil War.
From 1840-1860, profits in the iron business ranged from 40-60 percent, sometimes reaching 100 percent. Maryland was seventh in the nation in iron production in 1860, rising to fifth by 1870. The production of iron in Maryland declined sharply after that. The Maryland ore was never that good, and the discovery of rich veins in the West put the smaller, locally furnaces out of the iron business. Ruins of two of the furnaces are still visible in the town of Mount Savage, The Mount Savage blast furnaces had their own railroad branch, extending 1.3 miles from the main line. Bits of this roadbed can still be found

The furnace complexes at Lonaconing and Mount Savage may both have been too technologically advanced for their time. The Lonaconing facility had suffered from a lack of transportation. This error was not repeated at Mount Savage. However, the politics of international trade skewed the equations in favor of imported rather than home-produced iron. Cast iron, extracted from ore, is at best an intermediate product. Cast iron is only suitable for a limited number of products. The next step in production involves another furnace and a rolling mill.

The following page shows a reproduction of what we would now call a production spreadsheet.

MOUNT SAVAGE BLAST FURNACE, No. 1

STATEMENT OF WORK and COST OF IRON for Week ending 23^d June 1856

Coke	used	7 charges a 1005 lbs. ea. 246 ~ 1680 3		Tons 187.60
Limestone	"	253		91.30
				278.90
Ores	"	Fossil	Tons 161.00	
		Cross Cut	31.50	
		South Branch		
		Roasted Cinder	22.00	
		Clear Spring	214.50	
		Scrap Iron		

Pig Iron made . . . . Tons 84 ~ ~ ~

Yield of above mixture of Ores 39 17/100 per cent. or 2 55/100 tons Ore per ton Iron

Coke	used per ton Iron	2.23	tons a $ 3.00		$	6 69
Limestone	" " "	1.08	" a $ .79			~ 85
Ores	" " "	Fossil 1.91	tons a $ 3.00	$ 5.73		
		Cross Cut .37	" $ 3.00	$ 1.11		
		South Branch	" $	$		
		Cinder .27	" $ .20	$ 0.05		
		Clearspring	" $	$		6 89
		Scrap Iron	" $	$		
			$	$		
			$	$		

Wages, per time list, inclusive of salary of Manager,

$ 331.99 divided by 84 tons	3 95
96 cars Coal to Engine 146 55/100 tons a $ 1.20 divided by 84 Tons	2 09
Materials, per Store and other accounts, viz; Oil, Tallow, Hemp, Packing Yarn, Steel, Leather, Shovels, Buckets,	~ 65
~~Nails, &c.,~~ &c. Expenses for Repairing damage by Fire	~ 84
Cost of one ton Pig Iron	$ 21 96

Original record taken from only remaining records. All other records of the company were lost in the great Baltimore fire.

Mt. Savage Iron Works, 7
185 7

Sam^l Danks Superintendent.

The Rolling Mill, and the First Iron Rail

The iron furnaces produced cast iron, an intermediate product. Early rails were cast, but these were prone to fracture. Pig iron is good for some things, but a better product was needed. This section examines the next step – a value-added process to turn pig iron into rails and motive power. A forge and rolling mill had been planned for the facility at Lonaconing, but these were never built.

In 1842, the American Railroad Journal had said in an editorial that there was no firm in the United States capable of manufacturing heavy-edged rail. Many facilities had tried and failed to produce an acceptable product. The market was apparent and the Mount Savage rolling mill was built in 1843 by the Maryland & New York Iron & Coal Company. The rolling mill site had 3 trains of rollers driven by steam engines, 17 puddling furnaces, 6 reheating furnaces, and 3 special facilities for sheet iron production. The furnaces were of the Siemens type, using coal gas produced on site as a byproduct of coke production as fuel.

A medal for the process was awarded in October 1844 from the Franklin Institute of Philadelphia. The medal was at one time a part of the collection of the Museum of Ince Blundell in Lancashire, England. In 1844, there was just over 4,000 miles of railroad in America.

The Mount Savage open hearth furnaces were not making true steel – something between malleable iron and mild steel. The difference between cast iron, wrought iron, and steel is a percentage point or two of carbon. The rival Bessemer process was patented in England in 1856. It was the first inexpensive way to produce steel from pig iron. Air is blown through the molten iron, removing impurities such as silicon, manganese, phosphorus, and excess carbon. The Bessemer process was superseded by the open hearth furnace by the run of the century,

William and Frederick Siemens built their first experimental furnace in 1858, and got a patent in 1861. By 1868, they finally demonstrated the production of steel from pig iron.

The Siemens puddling furnace was a rectangular, covered design that passed burning gas over the top of the charge of pig iron. The early models had a 4-5

ton capacity. The concept was to purify the pig iron by oxidation of the carbon, and to remove impurities. The contact with the products of combustion can be controlled by controlling the draft, and it can be used to add or remove material from the melt. It can produce mild steel from pig iron by lowering the carbon content.

Puddling furnaces were making malleable iron out of pig iron in England as early as 1784. In these, the molten metal with a layer of floating slag is stirred for 5-10 minutes of clearing. This causes the oxidation of contaminates in the iron, mainly silicon, manganese, and phosphorous. The temperature in the furnace was raised to the boiling point of iron, 4,982 degrees F. The puddler's job was a particularly hot and dangerous one. He stirred the molten iron with a long rod, to bring the slag and impurities to the surface, where they could be skimmed off. Still, it was probably a better job than in the nearby mines. His skill was also critical. There was no way to accurately measure the temperature of the melt, except by its color. The ironmaster's experience and calibrated eyeballs were the key to success or failure of the process.

After clearing, the temperature in the furnace was raised. After another 10 minutes of stirring, carbon monoxide gas would begin to escape the melt as bubbles, which catch fire as they burst. This phenomenon was called puddler's candles. When they disappeared, more stirring was called for. This got increasingly difficult, as globules of decarburized iron formed. These 150 pound semi plastic balls were grasped by tongs and removed from the furnace. These were then hammered or squeezed by rollers. The resulting rough bars were cut into short pieces, and went into a reheating furnace. Here, they were taken to white heat – a self-welding temperature. They would be worked and reheated numerous times. Each reworking with a hammer or rollers removed more slag.

For the rolling operation, the worked iron was again reheated, and passed through the rolls multiple times to get the correct shape. The Mount Savage rail of 1844 was a U shaped design. Rolled rail would have a natural curvature as it cooled, and would be bent until straight. The rail would then be weighed for quality purposes, and stamped. Later, heat-treating of the working face

would be used. Plate was also rolled in a similar process to rails. It would be sheared to size, and holes for rivets would be punched.

The production of coal gas is a byproduct of coke production, but in carefully designed reactors, a better grade of gas is produced. Typically, a producer reaction vessel is used, being constructed of cylindrical steel like a boiler, and lined with firebrick. It was partially filled with coal or coke. A blast of air, and sometimes steam, was introduced from the bottom. These reactors consume several tons of coal per hour.

Puddling furnace

A successful rolling mill had been placed in operation in England as early as 1783, and cold rolling began in Pittsburgh in 1860.

In addition to rolled product such as rail, the production facility could produce wrought iron sheet. Rolled into cylinders and riveted, this made the production of locomotive boilers possible. In addition, wrought iron was used in the production of chain, engine bolts, stay bolts, pipe and threaded parts, and drawbars.

The first successful output of the Mount Savage mill was in 1844, and marked the end of the U. S. dependence on imported products. Interestingly, in the same year, iron ore was discovered around Lake Superior. This would lead to the demise of Mount Savage in particular and Maryland in general, as world-class iron producers.

The 43 pounds to the yard rail was used for the home road and sold to the B&O railroad, which up to that time had been dependent on imported British rail. One thousand tons of rail, at $59 per ton, went to a railroad at Fall River, Massachusetts. Most interestingly, the Mount Savage facility used its own product to build the Mount Savage Rail Road, down the Jennings Run and through the Narrows, to connect with the B&O at Cumberland. An additional customer included the Hampshire Coal & Iron Company for their tram road near Piedmont, WV. The Utica & Schenectady and the Hudson River Railroad in New York, and the Erie and the Reading in Pennsylvania were also customers. The Utica and Schenectady Railroad ordered 1,000 tons of rail. There was a display of Mount Savage rail at the Mechanics Fair in Baltimore in November 1850. E. Pratt & Brother were the agents.

During the Civil War, the facilities at Mount Savage went back to work. Some 333 tons of railroad iron from Mount Savage were taken by US forces in 1864 in Louisiana. The government reimbursed the company for the cost. The rail had originally been sold to the El Paso Pacific Company in Texas, but never used. Some 53 tons were lost to Confederate forces.

John W. Brown of Mount Savage was granted a patent for a T-iron rail rolling mill in April 1856. It describes a five-step process, which not only forms bar iron into rail, but controlled the displacement and density of the finished shape, and the hardness of the wearing surfaces.

In the 1850’s, the Mount Savage facilities employed 900. Jobs at Mount Savage attracted both skilled and unskilled immigrants from Ireland, England, and Wales. In foundries and machine shops wages were relatively stable from the early 1880’s to the 1910’s. A machinist or boilermaker would make about $2.50 per 10-hour day, 6 days a week, 300 days per year. There was no vacation, no sick leave, no holidays except for Christmas day. The employees were paid in script, exchangeable at the company store, until the 1880's

The firm of Manning & Lee, Charles & Towsend Streets, Baltimore, were Agents for the Mount Savage works. In 1845 and 1846, they brokered the sale of “T” rail to a Boston Purchaser. This is most likely the delivery for the Fall River, Massachusetts, railroad.

Industrial safety was a concept that developed slowly and the iron shops of the 19th century were dangerous places to work. As part of the social contract men injured at work usually had guaranteed lifetime employment -- if they survived.

Where many hundreds of men labored in literally hellish conditions, a stranglehold on the rail industry by British industry was broken, and the tools for enabling the industrial expansion of the United States were produced.

Other small facilities

This sections discusses other smaller iron making facility's in Western Maryland.

Bowery furnace

Midlothian is located south of Frostburg, and to the west of Route 936. Also know as Midlothian Junction, it has a population of 320 in 2010. It was primarily settled by Scotch immigrants, and named after a region near Edinburgh.

The village of Midlothian was the site of the Bowery iron furnaces. These were two coke-fired furnaces built in 1868 by Cumberland Coal and Iron. There was a source of carbonate iron ore on the hill to the northeast, tapped by a tram road. Limestone was available from a hill to the east. The furnaces produced pig iron, and operated from 1874 to 1880. The pig iron was shipped by rail on the C&P via a spur line off the main. The product went to Cumberland. The furnaces were operated for 7 years.

Lena furnace in Cumberland

The Lena furnace was located east of the City on the Mount Savage Rail Road. It was built in 1846 by a New Yorker, J. F. Penniman. The local agent was T. J. McKay, It was 28 feet high, and 8 feet wide at the boshes. It was a hot-blast design. The furnace operated until 1852, when it was shut down, but re-opened during the Civil War.

Bolt & Forge

The Baltimore & Ohio Railroad's Bolt and Forge facility in Cumberland used scrap railroad material as a feedstock.

There was a rolling mill, built in 1870 for rail production. A bar mill was added in 1873. There were 3 single and 15 double puddling furnaces, 16 heating furnaces, 8 trains of rollers, and two hammers.

Cumberland Steel

The Cumberland Steel Company was established by the McKaig family in 1892. The main building was built in 1893, but was later completely destroyed by fire around 1907. It had employed 90 men at the time. The plant was rebuilt, and, in 1908, it was reported to have more than 150 employees. It was then called the Cumberland Steel and Shafting Company. As of 1889, it was reported to have 22 heating and welding furnaces. A Siemens steel-melting furnace, 5 hammers, including a 1,000 lb drop hammer, 2 trains of rollers. It was also equipped with 10 and 20-ton presses There were plans to add a 10-ton open hearth furnace, but it is unclear whether this was done. In 1922, General Manager and Vice President Walter Muncaster resigned from the company after 30 years of service. He was the technical brains behind the facility, holding patents on several key areas, including measuring instruments, lathe rests, bending press, crane, grinding machine, water tubes for steam boilers, shafting machines, rolling mill, thread roller, etc. The building still stands in Cumberland on Queen City Drive

Wrap-up

In the 1840's, Western Maryland had everything needed for high technology products. It was a previous generation's Silicon Valley. Raw materials were cheap and plentiful. Land was cheap. Labor flocked to where good wages were paid. Industrialists saw the opportunities. Infrastructure was an issue, but could be overcome. The early facilities at Lonaconing and Mount Savage helped set the United States on a path to manufacturing might, and a leader of the world's economy. The efforts in producing iron products drove the transportation infrastructure of the nation.

Glossary

Bessemer Converter – furnace to make steel from iron by removing contaminants.

Bituminous coal – an organic sedimentary rock of mostly carbon.

Blacksmith – creates items from wrought iron.

Blast furnace – furnace to produce iron from iron, and using a forced blast of air to get better combustion.

Bloom – a porous mass of iron and slag, called sponge iron.

Bloomery – a crude iron production facility for small batches.

Blowing engine – a large cylinder powered by a steam engine to produce the blast for the furnace.

Bog iron – poor quality iron made from ore found in swampy areas.

Bosh - lower part of a blast furnace, between the hearth and the stack.

Chafery – a reheating hearth, to work pig iron into wrought iron.

Charcoal – produced by heating wood in the absence of oxygen. Nearly pure carbon.

Coal – a mineral, mostly carbon, with a variety of other trace elements.

Coal gas – by product of coke production

Coke – produced by destructive distillation of coal. Is mostly pure carbon.

Finery forge – facility to produce wrought iron from pig iron, by removing carbon.

Fire clay – silica and alumina.

Flux – material to bind with and capture the impurities in the iron ore.

Forge – a heating furnace with forced draft, fueled by charcoal or coal.

Hematite – iron ore, predominate in Western Maryland

Iron - element number 26.

Limestone – sedimentary rock, calcium carbonate.

Open Hearth Furnace – converts pig iron to steel. Replacement for the Bessemer furnace.

Puddlers candle – bubbles of carbon monoxide produced in a puddling furnace. Burst at catch fire at the surface.

Pig iron – iron ore with the oxygen removed. Iron ore is rust – iron bonded with oxygen.

Puddling furnace – converts pig iron to steel or wrought iron. Hot air passes over the molten iron.

Reducing agent – removes oxygen from a material. Carbon is used with iron.

Reduction process – opposite of oxidation. Oxygen is removed.

Reverberatory furnace – used to make iron and mild steel. The molten iron is isolated from contact with the fuel, but does contact the combustion gases.

Rolling Mill – process to shape hot iron into long sheets by squeezing between rollers.

Siemens regenerative furnace – circa 1865 open hearth furnace design.

Slag – the impurities extracted from the iron ore; a glassy material when cooled.

Smelting - extractive technique in metallurgy to produce metal from ore.

Steel – iron with a carbon percentage of 0.2 to 2.14%. Stronger than iron.

Tuyeres – nozzle to introduce the blast into the furnace. Water-cooled.

Wrought iron – pig iron worked to reduce contaminants and carbon.

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